



# Full wwPDB X-ray Structure Validation Report ⓘ

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PDB ID : 23QH / pdb\_000023qh  
Title : Structure of importin alpha bound to the Psittacine Adenovirus B Fiber 1 protein nuclear localization signal  
Authors : Forwood, J.K.  
Deposited on : 2026-02-13  
Resolution : 2.10 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0  
Xtrriage (Phenix) : 2.0  
EDS : 3.0  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.48.1

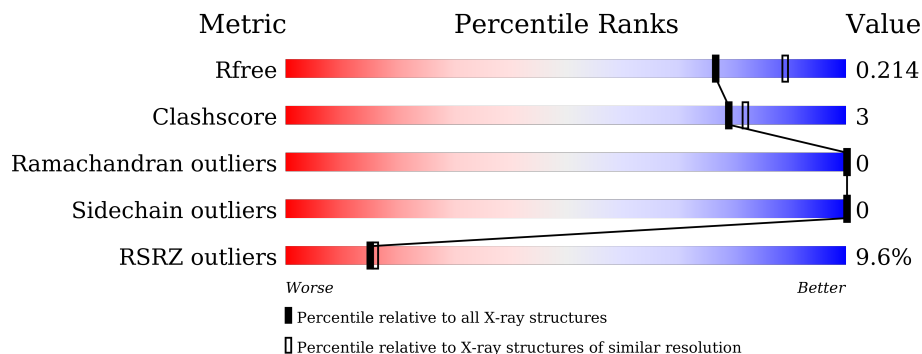
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.10 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	164625	6234 (2.10-2.10)
Clashscore	180529	6893 (2.10-2.10)
Ramachandran outliers	177936	6839 (2.10-2.10)
Sidechain outliers	177891	6840 (2.10-2.10)
RSRZ outliers	164620	6234 (2.10-2.10)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	E	510	
2	A	27	
2	C	27	

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 6959 atoms, of which 3456 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Importin subunit alpha-1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	E	426	6564	2066	3320	550	618	10	0	0	0

There are 50 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	20	MET	-	initiating methionine	UNP P52293
E	21	HIS	-	expression tag	UNP P52293
E	22	HIS	-	expression tag	UNP P52293
E	23	HIS	-	expression tag	UNP P52293
E	24	HIS	-	expression tag	UNP P52293
E	25	HIS	-	expression tag	UNP P52293
E	26	HIS	-	expression tag	UNP P52293
E	27	SER	-	expression tag	UNP P52293
E	28	SER	-	expression tag	UNP P52293
E	29	GLY	-	expression tag	UNP P52293
E	30	LEU	-	expression tag	UNP P52293
E	31	VAL	-	expression tag	UNP P52293
E	32	PRO	-	expression tag	UNP P52293
E	33	ARG	-	expression tag	UNP P52293
E	34	GLY	-	expression tag	UNP P52293
E	35	SER	-	expression tag	UNP P52293
E	36	GLY	-	expression tag	UNP P52293
E	37	MET	-	expression tag	UNP P52293
E	38	LEU	-	expression tag	UNP P52293
E	39	GLU	-	expression tag	UNP P52293
E	40	THR	-	expression tag	UNP P52293
E	41	ALA	-	expression tag	UNP P52293
E	42	ALA	-	expression tag	UNP P52293
E	43	ALA	-	expression tag	UNP P52293
E	44	LEU	-	expression tag	UNP P52293
E	45	PHE	-	expression tag	UNP P52293
E	46	GLU	-	expression tag	UNP P52293

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Chain	Residue	Modelled	Actual	Comment	Reference
E	47	ARG	-	expression tag	UNP P52293
E	48	ASN	-	expression tag	UNP P52293
E	49	HIS	-	expression tag	UNP P52293
E	50	MET	-	expression tag	UNP P52293
E	51	ASP	-	expression tag	UNP P52293
E	52	SER	-	expression tag	UNP P52293
E	53	PRO	-	expression tag	UNP P52293
E	54	ASP	-	expression tag	UNP P52293
E	55	LEU	-	expression tag	UNP P52293
E	56	GLY	-	expression tag	UNP P52293
E	57	THR	-	expression tag	UNP P52293
E	58	ASP	-	expression tag	UNP P52293
E	59	ASP	-	expression tag	UNP P52293
E	60	ASP	-	expression tag	UNP P52293
E	61	ASP	-	expression tag	UNP P52293
E	62	LEU	-	expression tag	UNP P52293
E	63	ALA	-	expression tag	UNP P52293
E	64	MET	-	expression tag	UNP P52293
E	65	ALA	-	expression tag	UNP P52293
E	66	ASP	-	expression tag	UNP P52293
E	67	ILE	-	expression tag	UNP P52293
E	68	GLY	-	expression tag	UNP P52293
E	69	SER	-	expression tag	UNP P52293

- Molecule 2 is a protein called Peptide from Fiber 1 protein.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace	
2	C	8	Total	C	H	N	O	0	0	0
			163	46	90	19	8			
2	A	4	Total	C	H	N	O	0	0	0
			84	23	46	11	4			

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	E	146	Total	O	0	0
			146	146		
3	C	2	Total	O	0	0
			2	2		



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	78.73Å 89.78Å 99.73Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.60 – 2.10 29.60 – 2.10	Depositor EDS
% Data completeness (in resolution range)	100.0 (29.60-2.10) 95.5 (29.60-2.10)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.85 (at 2.10Å)	Xtrriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, $R_{free}$	0.197 , 0.215 0.197 , 0.214	Depositor DCC
$R_{free}$ test set	2015 reflections (4.80%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	37.8	Xtrriage
Anisotropy	0.462	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.41 , 41.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	6959	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	59.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.70% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 5$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z  >5	RMSZ	# Z  >5
1	E	0.10	0/3302	0.26	0/4500
2	A	0.18	0/38	0.30	0/47
2	C	0.14	0/74	0.30	0/95
All	All	0.11	0/3414	0.26	0/4642

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	E	3244	3320	3320	18	0
2	A	38	46	46	0	0
2	C	73	90	90	1	0
3	C	2	0	0	0	0
3	E	146	0	0	0	0
All	All	3503	3456	3456	18	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 3.

All (18) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:435:LYS:HD3	1:E:438:GLN:OE1	2.02	0.59
1:E:474:GLU:OE2	1:E:477:GLN:NE2	2.39	0.56
1:E:318:GLY:O	1:E:322:THR:HG23	2.09	0.53
1:E:181:GLN:OE1	2:C:48:ARG:NH1	2.41	0.52
1:E:426:MET:HE1	1:E:444:ILE:CD1	2.40	0.52
1:E:459:LYS:N	1:E:459:LYS:HD3	2.28	0.48
1:E:470:LEU:HD13	1:E:470:LEU:O	2.14	0.48
1:E:340:PHE:N	1:E:341:PRO:CD	2.77	0.48
1:E:106:ARG:NE	1:E:108:LYS:O	2.46	0.47
1:E:426:MET:HE1	1:E:444:ILE:HD11	1.95	0.47
1:E:386:LEU:HD21	1:E:425:LEU:HD23	1.96	0.47
1:E:452:GLU:OE2	1:E:495:TYR:CE2	2.67	0.47
1:E:470:LEU:HD23	1:E:496:PHE:CE2	2.51	0.45
1:E:459:LYS:N	1:E:459:LYS:CD	2.80	0.45
1:E:114:ASN:OD1	1:E:117:ARG:NH1	2.46	0.43
1:E:238:ARG:O	1:E:239:ASN:HB2	2.17	0.43
1:E:321:VAL:HG21	1:E:358:THR:HG23	2.04	0.40
1:E:108:LYS:O	1:E:109:GLN:C	2.64	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles [i](#)

### 5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	E	424/510 (83%)	413 (97%)	11 (3%)	0	100	100
2	A	2/27 (7%)	2 (100%)	0	0	100	100
2	C	6/27 (22%)	6 (100%)	0	0	100	100
All	All	432/564 (77%)	421 (98%)	11 (2%)	0	100	100

There are no Ramachandran outliers to report.

### 5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	E	357/426 (84%)	357 (100%)	0	100	100
2	A	4/23 (17%)	4 (100%)	0	100	100
2	C	8/23 (35%)	8 (100%)	0	100	100
All	All	369/472 (78%)	369 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	E	175	HIS
1	E	263	ASN
1	E	350	ASN
1	E	446	ASN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

### 5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

### 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	E	426/510 (83%)	0.38	38 (8%) 17 18	35, 50, 105, 129	0
2	A	4/27 (14%)	2.74	2 (50%) 0 0	78, 86, 95, 103	0
2	C	8/27 (29%)	1.50	2 (25%) 2 2	47, 63, 82, 94	0
All	All	438/564 (77%)	0.42	42 (9%) 15 16	35, 50, 105, 129	0

All (42) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	A	44	PRO	4.8
2	C	42	PRO	4.4
1	E	489	LEU	3.9
2	C	49	LEU	3.8
1	E	431	ALA	3.7
2	A	47	ARG	3.7
1	E	497	SER	3.7
1	E	492	ILE	3.5
1	E	485	TYR	3.4
1	E	73	THR	3.4
1	E	487	ALA	3.3
1	E	303	GLY	3.3
1	E	473	ILE	3.2
1	E	74	VAL	3.2
1	E	470	LEU	3.1
1	E	496	PHE	3.0
1	E	484	VAL	3.0
1	E	479	HIS	2.9
1	E	491	LEU	2.9
1	E	488	SER	2.9
1	E	108	LYS	2.9
1	E	483	SER	2.9
1	E	132	ASP	2.7

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Mol	Chain	Res	Type	RSRZ
1	E	472	LYS	2.7
1	E	88	ASN	2.5
1	E	450	ALA	2.4
1	E	433	ASP	2.3
1	E	391	PHE	2.3
1	E	436	ILE	2.3
1	E	434	THR	2.3
1	E	475	ALA	2.3
1	E	291	LYS	2.2
1	E	430	SER	2.2
1	E	477	GLN	2.2
1	E	493	GLU	2.1
1	E	476	LEU	2.1
1	E	459	LYS	2.1
1	E	72	GLY	2.1
1	E	457	THR	2.1
1	E	284	GLU	2.1
1	E	406	SER	2.0
1	E	448	PHE	2.0

## 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

## 6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

## 6.4 Ligands [i](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.